REMARKS

This Amendment is submitted in response to the Official Letter dated March 21, 2002. Claims 1, 2, 5 through 7, 10, 16 and 17 have been amended. Claims 3, 4, 8, 9, 11 and 12 have been cancelled. The application now includes claims 1, 2, 5 through 7, 10 and 13 through 17, with claims 1 and 10 being independent claims. Favorable reconsideration of the application, as amended, is respectfully requested.

In the Official Letter, the Examiner rejected claims 4 through 6 and 9 under 35 U.S.C. §112, fourth paragraph, as involving a method limitation in an apparatus claim. Applicants have cancelled claims 4 and 9. Additionally, applicants have amended claim 5 to recite that the mold segments and top core cooperate to define a wheel mold cavity shape for casting a one piece wheel. Similarly, applicants have amended claim 6 to recite that the mold segments and top core cooperate to define a wheel mold cavity shape for casting a full face wheel disc. Applicants believe that amended claims 5 and 6 now recite a structural limitation in place of a method limitation. Accordingly, claims 5 and 6 limit the scope of base claim 1 and applicants respectfully request that the Examiner withdraw his rejection of the claims under 35 U.S.C. §112, fourth paragraph.

The Examiner also rejected claims 1 through 17 under 35 U.S.C. §103(a) as being unpatentable over German Patent No. DE 36 19 525 C to Bendig in view of applicant's admitted prior art as set forth in pages 1 and 2 of the specification. The Examiner stated that the Bendig reference teaches a low pressure casting process for casting a motor vehicle wheel that includes application of vibration to the casting mold during the solidification process of the molten metal. The Examiner also stated that the Bendig reference does not state the structure of the casting mold, but that the admitted prior art shows that it is conventional to gravity or pressure cast a vehicle wheel with a multi-segment mold. The Examiner then concluded that it would be obvious to use the prior art multi-segment mold with the vibration taught by the Bendig reference. The Examiner further stated that it would have been obvious to use an appropriate type of vibrator and to place the vibrator in an appropriate location

upon the mold. The Examiner also stated that it would have been obvious to obtain the optimal timing of the vibration through routine experimentation.

Applicants have amended independent claim 1 to recite a pneumatically powered vibration device mounted adjacent to a top core segment with the vibration device operative to vibrate the top core segment when supplied with compressed air. Claim 1 also has been amended to recite a supply of compressed air connected to the vibration device. Amended claim 1 further recites that the compressed air supply includes a solenoid valve for controlling the flow of compressed air to the vibration device and an adjustable pressure regulator for controlling the speed and force of the vibration device.

Nothing in the Bendig reference shows or suggests the location of the vibration device. Additionally, nothing in the Bendig reference shows or suggests a pneumatically powered vibration device and a supply of compressed air that includes a solenoid valve and pressure regulator for controlling the application of the compressed air to the vibration device. The Bendig reference is silent concerning the type of vibration device selected. Thus, the Bendig device could well be teaching the use of electro-magnetic vibration device. The selection of a pneumatically powered vibration device with a controlled air supply provides several benefits, as described on page 5, lines 2 through 7, where it is stated that:

> The compressed air, which is not affected by the high temperatures encountered in a foundry, can be supplied from a readily available source, such as tapping into the foundry air supply. The compressed air flows though a regulator (not shown) for controlling the pressure to adjust the speed and force of the vibrator. In the preferred embodiment, the air pressure is adjustable over range of from 60 pounds per square inch (psi) to 100 psi.

The Bendig reference does not show or suggest an adjustable pressure regulator, as recited in amended independent claim 1, that permits adjustment of the speed and force of the vibration device. The Bendig reference only teaches that the

mold is preferably vibrated in the range of 15,000 to 25,000 HZ. There is no teaching in the Bendig reference that the device is adjustable within the stated vibration range.

Applicants do not believe that the structural limitations included in amended independent claim 1 would be obvious from the teachings of the Bendig reference in view of the prior art multi-segment described within the application. Accordingly, applicants believe that amended independent claim 1 is patentable over the art of record and respectfully request that the Examiner withdraw his rejection of the claim.

Claims 4 through 7 are dependent upon amended independent claim 1. Accordingly, for the reasons given above, applicants also believe that claims 4 through 7 are patentable over the art of record and respectfully request that the Examiner withdraw his rejection of the claims.

Applicants also amended independent claim 10 to recite providing a pneumatically powered vibration device to vibrate a top core of a multi-segment mold. Amended claim 10 also recites supplying compressed air to the vibration device upon completion of filling the mold cavity with molten metal and then shutting off the supply of compressed air after a portion of the time required for the metal to solidify has elapsed. Amended claim 10 further recites that the metal in the mold cavity is then allowed to continue to cool until the molten metal is solidified.

Nothing in the Bendig reference shows or suggests a timing cycle for vibrating the mold. Applicants do not believe that the vibration timing cycle recited in amended claim 10 would be obvious from the teachings of the Bendig reference in view of the prior art multi-segment described within the application. There is no incentive in either the Bendig reference or the admitted prior art to begin vibration following filling of the mold with molten metal and then ending the vibration after only a portion of the time required for the metal to solidify has elapsed. Indeed, the applicants have found that the application of vibrations have provided several benefits, as outlined on page 5, lines 18 through 26 of the specification, where it is stated that:

> The inventors have found that vibration of the mold 20 while the molten metal contained therein solidifies has significantly reduced the

solidification time for a wheel casting. During tests, the solidification time has been reduced from six minutes without vibration to 4 to 5 minutes. Thus, vibration can reduce solidification time by 20 to 33 percent. Additionally, the inventor has observed that, with vibration, the microstructure grain size of a wheel casting is reduced from the size resulting without vibration. Also, the spacing of the dendrite arms within the casting is reduced when the mold is vibrated while the metal solidifies. Accordingly, the tensile strength of the wheel is improved by the application of vibration.

Accordingly, applicants believe that amended independent claim 10 is patentable over the art of record and respectfully request that the Examiner withdraw his rejection of the claim.

Claims 13 through 17 are dependent upon amended independent claim 10. Accordingly, for the reasons given above, applicants also believe that claims 13 through 17 are patentable over the art of record and respectfully request that the Examiner withdraw his rejection of the claims.

In view of the amendments and above remarks, it is believed that the application is in condition for allowance.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Replace the paragraph beginning on Page 5, Line 18 with the following new paragraph:

The [inventor has] inventors have found that vibration of the mold 20 while the molten metal contained therein solidifies has significantly reduced the solidification time for a wheel casting. During tests, the solidification time has been reduced from six minutes without vibration to 4 to 5 minutes. Thus, vibration can reduce solidification time by 20 to 33 percent. Additionally, the inventor has observed that, with vibration, the microstructure grain size of a wheel casting is reduced from the size resulting without vibration. Also, the spacing of the dendrite arms within the casting is reduced when the mold is vibrated while the metal solidifies. Accordingly, the tensile strength of the wheel is improved by the application of vibration.

IN THE CLAIMS

Substitute the following amended Claims 1, 2, 5 through 7, 10, 16 and 17 for the pending claims of the same number:

1. (Amended) An apparatus for casting a vehicle wheel component comprising:

a [multi-segment mold for the vehicle wheel component] mold base segment;

a plurality of movable mold side segments

a movable top core segment, said top core segment co-operating with said base and side segments to define a mold for casting a vehicle wheel component; [and]

a pneumatically powered vibration device [for vibrating a portion of said mold] mounted adjacent to said top core segment and is operative to vibrate said top core segment when supplied with compressed air, said pneumatically powered vibration device having an inlet port for receiving compressed air;

a supply of compressed air connected to said inlet port of said vibration device;

a solenoid valve included in said compressed air supply for controlling the flow of compressed air into said inlet port of said vibration device; and

an adjustable pressure regulator included in said compressed air supply, said pressure regulator controlling the speed and force of said vibration device.

2. (Amended) [An] The apparatus according to claim 1 wherein said [device for vibrating includes] vibration device is a ball vibrator.

5. (Amended) [An] The apparatus according to claim [4] 2 wherein said mold [forms] segments and top core cooperate to define a wheel mold cavity shape for casting a one piece vehicle wheel.

6. (Amended) [An] The apparatus according to claim [4] 2 wherein said mold [forms] segments and top core cooperate to define a wheel mold cavity shape for casting a full face wheel disc.

7. (Amended) [An] The apparatus according to claim 1 wherein said [device for vibrating includes] vibration device is a reciprocating hammer.

10. (Amended) A method for forming a vehicle wheel component casting comprising the steps of:

(a) providing a multi-segment mold having a top core for casting the wheel component, the top core having a pneumatically powered vibration device mounted adjacent thereto, the vibration device being selectively operable to vibrate the mold top core [and a device for vibrating a portion of the wheel mold];

(b) filling the cavity of the wheel component mold with a charge of molten metal;

(c) [vibrating a portion of the wheel component mold while] supplying compressed air to the vibration device to vibrate the top core upon completion of the filling of the mold cavity with molten metal for a portion of the time required for the

molten metal [solidifies] to solidify;

(d) shutting off the supply of compressed air to the vibration device after the portion of the time required for the metal to solidify has elapsed;

(e) allowing the metal in the mold cavity to continue to cool until the metal is solidified;

(f) opening the mold; and

(g) removing the wheel component casting from the mold.

16. (Amended) The method according to claim 14 wherein the multi-segment mold provided in step (a) forms a one piece vehicle wheel.

17. (Amended) The method according to claim 14 wherein the multi-segment mold provided in step (a) forms a full face wheel disc.

Cancel claims 3, 4, 8, 9, 11 and 12.